EC-409D	RF SYSTEM DESIGN (ELECTIVE - V)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To know the physics of CMOS devices and the origin of noises in RF systems.
2. To know the concepts of high frequency and low noise amplifier amplifier design
3. To know the concepts of stability and power amplifier fundamentals
4. To know the role of PLLs and frequency synthesizers in RF system design
5. To know the role of mixers and oscillators in RF system design

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the role of CMOS devices physics and noise sources in the design of RF systems
2. understand the design intricacies of high frequency and low noise amplifiers
3. determine the stability using gain and phase margins and root locus techniques, and linearising techniques for power amplifiers
4. underastand the working of PLLs and frequency synthesizers
5. understand the principles of designing oscillators and mixers in RF systems

UNIT I **(10)**

Introduction to mosfet physics, noise, thermal, shot, flicker, popcorn noise, two port noise theory, noise figure, thd, ip2, ip3, sensitivity, sfdr, phase noise, specification distribution over a communication link, homodyne receiver, heterodyne receiver, image reject, low if receiver architectures, direct up conversion transmitter, two step up conversion transmitter.

UNIT II **(10)**

Impedance matching and amplifiers, s-parameters with smith chart, passive ic components, impedance matching networks, common gate, common source amplifiers, oc time constants in bandwidth estimation and enhancement, high frequency amplifier design, power match and noise match, single ended and differential LNAs, terminated with resistors and source degeneration LNAs.

UNIT III **(10)**

Feedback systems and power amplifiers, stability of feedback systems, gain and phase margin, root-locus techniques, time and frequency domain considerations, compensation, general model class A, AB, B, C, D, E and F amplifiers, power amplifier linearization techniques, efficiency boosting techniques, ACPR metric, design considerations.

UNIT IV **(10)**

Mixers and oscillators, mixer characteristics, non-linear based mixers, quadratic mixers, multiplier based mixers, single balanced and double balanced mixers, sub sampling mixers, oscillators, describing functions, colpitts oscillators, resonators, tuned oscillators, negative resistance oscillators, phase noise.

UNIT V **(10)**

PLL and frequency synthesizers, linearised model, noise properties, phase detectors, loop filters and charge pumps, integer-N frequency synthesizers, direct digital frequency synthesizers.

LEARNING RESOURCES:

TEXT BOOK(s):

Thomas Lee, The Design of Radio Frequency CMOS Integrated Circuits, 2nd Edition, Cambridge University Press, 2004.

REFERENCE BOOK(s):

1. Matthew M.Radmanesh - Radio frequency and Microwave Electronics illustrated, 1st Edition, Pearson Education, Delhi, 2000.
2. Reinhold Ludwig and Gene Bogdanov - RF Circuit Design Theory and Applications, 2nd Edition, Pearson Education, 2009.
3. Joseph Carr - Secrets of RF circuit design, 3rd Edition, TMH, 2001.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117102012/
2. www.rf-mw.org
3. www.rfcafe.com